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INHERITANCE IN MAN.

On the Inheritance of the Mental and Moral Characters in Man, and its Comparison with the Inheritance of the Physical Characters. By Karl Pearson. *Biometrika,* Vol. III (1904), Parts II and III, pp. 131–190.

Mr. Karl Pearson's article bearing the above title appears in the issue of *Biometrika* for March and July, 1904. The problems undertaken and the logically worked out conclusions will be found interesting by almost any thoughtful person, even without an understanding of complicated diagrams and tables with cross-headings.

Mr. Pearson thinks it impossible to deny wholly the inheritance of mental characters since the publication of "Hereditary Genius" and "English Men of Science," by Francis Galton. He himself holds very positive ideas on that subject in that he seeks to find an exact quantitative measure of the inheritance of mental characters, and a comparison of such measure with the corresponding measure for the physical characters. He has previously made two investigations which he considers give him ample means first, for determining the quantitative measure of the physical characters in man; and second, for the comparison of such inheritance with that of the physical characters in other forms of life. The comparison seems to him to show that there is no substantial difference between the inheritance of physique in man and in other forms of life. It is the purpose of the present investigation to show whether there is any substantial difference between the inheritance of physical and psychical characters in man.

In pursuing this inquiry, it is quite evident that Mr. Pearson has followed the only reliable plan of making children the object of his investigation, and teachers the source of information. The first part of the plan is justified in the fact that it is impossible to compare the moral character of a child with that of its adult parents, as also to estimate the resemblance between the child and what its parents were as children. Neither can one secure an impartial estimate of the relative moral merits of parents and offspring as adults. Fraternal resemblances are, accordingly, the ones sought and studied. The author reasons that, if *fraternal resemblance* for the moral and mental characters be less than, equal to, or greater than fraternal resemblance for the physical characters, we may safely argue that *parental inheritance* for the former set of characters is less than, equal to, or greater than that for the latter set of characters.

As to the source of information, the teacher who deals yearly with from 40 to 100 new children rapidly forms moderately accurate classifications, and makes a more impartial judge than the wholly partial parent or relative.

The material which forms the basis for the comparative study of the psychical and physical characters in man took upwards of five years to collect. Six thousand schedules were distributed, ten or twenty to a teacher, and three to four thousand schedules, representing about two hundred schools, were returned with more or less ample data. The schedules were white for a pair of brothers, pink for a pair of sisters, and blue for a brother and sister. Additional brothers were given on an attached white, and additional sisters on an attached pink, sheet. With the schedules was sent a head spanner, which afforded a sufficiently adequate means of obtaining the maximum length and breadth and auricular height of the living head. There were also distributed: (*a*) printed directions for the use of the head spanner; (*b*) general directions as to the estimation of both the physical and mental characters; and (*c*) two additional series of instructions suggested by some early, special inquiries. Copies of the schedules, general directions, and resulting tables of measurements are printed in Appendix I. (*Biometrika*).

The list of schools given shows that the investigation covers a variety of localities in every corner of the United Kingdom. While it might seem preferable to have dealt entirely with a single district having little immigration, the difficulties would probably have been insurmountable. It is true that an attempt was made to secure data from a limited area in Guernsey, and that the results (insignificant in amount) showed a slight variation from the English in physical but not in psychical characters. On the other hand, the results of previous investigations on similar lines compared with the school records indicate that local race is not largely influential in the inquiry under consideration. It is understood, then, that the constants deduced represent conditions in the nation at large.

The nature of the theory applied is explained with the aid of various kinds of diagrams and tables, few of which can be reproduced here. There are tables with cross-headings for the brother-brother, sister-sister, and brother-sister measurements for the following characters: cephalic index, head length, head breadth, and head height (auricular), health, eye color, hair color, curliness of hair, athletic capacity, vivacity, assertiveness, introspection, popularity, conscientiousness, temper, ability, and handwriting. Then there are tables deduced from these giving side by side for the three fraternal pairs the measure of resemblance of different observed characters, as also the mean of these measures.

From the tables different kinds of diagrams are plotted. On one the points are located by using the various units of measurement obtained and the frequency of the measurement for each unit. The result is a curve representing the distribution of measurements. The highest point in the more or less continuous curve is determined by the largest number of measurements for any one unit of measurement, and the downward slope on either side by the decreasingly small number of measurements given for succeeding units. The ends of the curve are, of course, determined by the extreme limits of the base or scale of measurements. A perpendicular dropped from the highest point in the curve cuts the base of measurements, so as to give the mean of observed measurements.

The diagram which is of the most importance in this investigation shows the resemblance within fraternal pairs for a given character. It is plotted by using the averages of observed units of measurement for those constituting the first half of the fraternal pairs and the mean measurements (arithmetically computed) of the corresponding arrays of brothers constituting the second half. The series of points thus obtained are found to lie almost on a straight line except those at the extreme ends, where, of course, the points represent exceptional conditions. For all practical purposes the only points worth considering are those lying on or near the straight line, since they represent the mass of observed measurements which are found to be concentrated within comparatively narrow limits in all of the characters investigated. The straight line passing through the points is called the line of regression, and its slope in comparison with the mean of the general population indicates the *measure* of fraternal resemblance. If the line of regression rose one for every one of the units of measurement traversed, its slope would indicate absolute resemblance between brothers (or within the pair considered); but, if it had no slope towards the general population mean (represented by a perpendicular at the point of mean measurement), there would be no resemblance at all.

The significant fact in this whole matter is that the measure of resemblance for each of the physical characters observed, with slight variation, is 0.5 (five-tenths). It is also found that 0.5, with scarcely greater variation, is the measure of the mental and moral characters observed. The psychical characters are not, of course, capable of exact measurement, and fall rather within certain classifications. To show the fraternal measure of such psychical characters, a diagram is plotted on which the scale of measurements is made up of classifications rather than of definite numerical units. Plotting for each classification the mean of the entire group of first brothers and the mean of the corresponding array of brothers, enough points are located to give the regression line and determine its slope, which is always found, as already stated, to be about five-tenths. Proceeding on the assumption of a normal distribution of measurements, a comparatively simple method gives practically the same result, 0.5, by taking two classifications at a time, and making within them a fourfold division of the two arrays of figures given for those classifications.

It is interesting to see that the modal (mean) boy is found toward the robust side of normally healthy, and that the modal ability of the girls (English) lies on the border line between intelligence and slow intelligence.

To show exactly the measure of fraternal resemblance in physical and mental and moral characteristics, two tables are given. Also a diagram is given which shows the approximation of these resemblances or correlations to a line representing five-tenths (.05). It is seen that for each of the three divisions, brothers, sisters, and brother-sister, there are eight points on the dotted and eight on the continuous line, and that these represent respectively, in the order given in the tables, the measure of fraternal resemblance of each of the eight physical and psychical characters.

The direct conclusion drawn from the results of the whole investigation is that mental and moral characters are inherited in exactly

TABLE III.

INHERITANCE OF THE PHYSICAL CHARACTERS.

SCHOOL OBSERVATIONS ON CHILDREN.

Character.	Correlation.		
	Brothers.	Sisters.	Brother and Sister.
Health	.52	.51	.57
Eye Color	.54	.52	.53
Hair Color	.62	.57	.55
Hair Curliness	.50	.52	.52
Cephalic Index	.49	.54	.43
Head Length	.50	.43	.46
Head Breadth	.59	.62	.54
Head Height	.55	.52	.49
Mean	.54	.53	.51

TABLE IV.

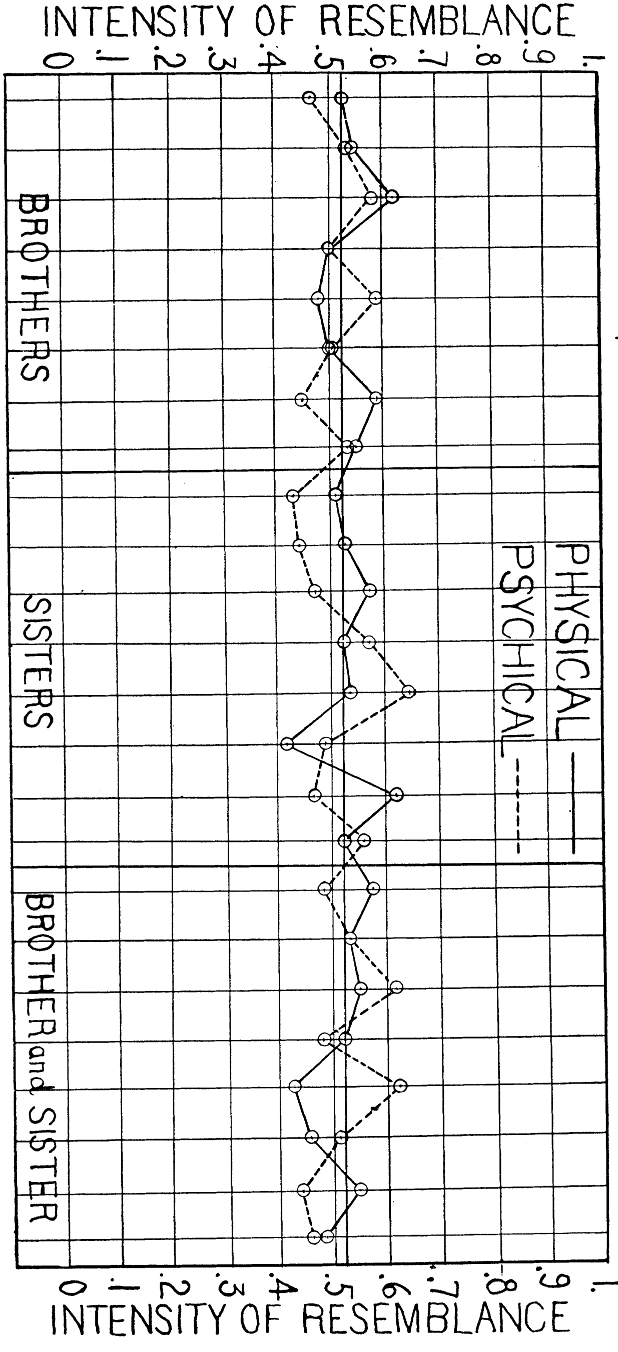
INHERITANCE OF THE MENTAL CHARACTERISTICS.

SCHOOL OBSERVATIONS ON CHILDREN.

Character.	Correlation.		
	Brothers.	Sisters.	Brother and Sister
Vivacity	.47	.43	.49
Assertiveness	.53	.44	.52
Introspection	.59	.47	.63
Popularity	.50	.57	.49
Conscientiousness	.59	.64	.63
Temper	.51	.49	.51
Ability	.46	.47	.44
Handwriting	.53	.56	.48
Mean	.52	.51	.52

the same way and in the same degree as physical characters. "We inherit our parents' temper, our parents' conscientiousness, shyness and ability, even as we inherit their stature, forearm, and span." . . . The man is not only physically, but mentally and morally, the product of a long line of ancestry. Evolution and selection play no greater and no less a part in the production of his psychical character than in the production of his physique. . . . "We know not why the living forms vary, nor why either physical or psychical characters are inherited, nor wherefore the existence at all of living forms, and their subjection to the great principle of selective evolution. We have learned only a law common to the physical and psychical. . . . The mission of science is not to explain, but to bring all things, as far as we are able, under a common law. . . . In the narrower field it has to study how its general conceptions bear on the comfort and happiness of man. Herein . . . lies especially the coming function of anthropology. Anthropology has, in the first place, to study man, to discover the sequence of his evolution from his present comparative stages and from his past history. But it cannot halt here. It must suggest how those laws can be applied to render our own human society more stable and efficient. In this function it becomes at least the handmaid of statecraft, if, indeed, it were not truer to call it the preceptor of statesmen."

What is the lesson to be learned from this investigation by communities? "Simply, that geniality and probity and ability may be



Comparison of Resemblance for Physical and Psychical Characters.

fostered, indeed, by home environment and by provision of good schools and well-equipped institutions for research, but that their origin, like health and muscle, is deeper down than these things. They are bred and not created. That good stock breeds good stock is a commonplace of every farmer. That the strong man and woman have healthy children is widely recognized, too. But we have left the moral and mental faculties as qualities for which we can provide amply by home environment and sound education. *It is the stock itself that makes its home environment: the education is of small service, unless it be applied to an intelligent race of men.*"

The author continues: "No scheme of wider or more thorough education will bring up in the scale of intelligence hereditary weakness to the level of hereditary strength. The only remedy, if one be possible at all, is to alter the relative fertility of the good and the bad stocks in the community. Let us have a census of the effective size of families among the intellectual classes now and a comparison with the effective size of families in the like classes in the first half of last century. You will, I feel certain, find, as in the case of recent like censuses in America, that the intellectual classes are now scarcely reproducing their own numbers, and are very far from keeping pace with the total growth of the nation. Compare in another census the fertility of the more intelligent workingman with that of the uneducated hand laborer. You will, I again feel certain, find that grave changes have taken place in relative fertility during the last forty years. We stand, I venture to think, at the commencement of an epoch, which will be marked by a great dearth of ability."

Mr. Pearson believes that to know the real source of evil is halfway to finding a remedy. "That remedy lies first in getting the intellectual section of a nation to realize that *intelligence can be aided and trained, but that no education* can *create* it. *It must be bred.* That is the broad result of statecraft which flows from the equality in inheritance of the psychical and physical characters in man."

ALICE UPTON PEARMAIN.